examination results, as a comparison of the sets of examination papers included at the end of the volume with the text of the book amply demonstrates, and it must be added that if an observant student carries out the simple experiments so clearly described at various places in the volume, he will have acquired a very desirable knowledge of the more important features of physiology. But so much cannot be said of the remainder of the text, which aims at far too much statement of detail for the space available, a matter in which the syllabus may be much more to blame than the author.

For example, the student who has learnt no chemistry previously will not be able to digest much from the description of the chemical elements given in a single page, and the same is true of the description of the chief inorganic compounds and the organic compounds of the body, each dismissed in less than a page.

The valuable habit of coordinating knowledge in the form of tables is visible at places in the book, but summaries have a way of becoming either too sweeping or too inexact, and we fear that the pupil, especially after such a concise training in chemistry as we have just indicated, may be in danger of concluding from a perusal of the table on p. 13 that the body contains "mineral salts" formed from a very strange combination of elements, or, from the table on p 162, that these same "mineral matters" share only "in forming bone and assist in digestion," and not that they are found in every cell and tissue in the body, and form as essential a constituent there as the all-important proteids, which are in the same table represented as the only tissue formers.

B. MOORE.

TERRESTRIAL MAGNETISM.

Terrestrial Magnetism and its Causes. By F. A. Black. Pp. xii+226. (London and Edinburgh: Gall and Inglis, 1905.) Price 6s. net.

WITH regard to the earth's magnetism, the general conclusions from observations made on its surface are that it is partly permanent, partly induced, and subject to the effects of electric currents in the earth's crust and the surrounding atmosphere. Moreover, that the direct action of the sun plays a comparatively subordinate part in producing the observed phenomena.

In this book, however, various reasons are submitted for the belief that the general magnetism of the earth, and the constant changes thereof as shown by the hourly variations of the needle, are due to causes external to the earth. In short, that the earth is to be considered as an electromagnet excited by electric currents proceeding from the sun and impelled towards the earth with inconceivable rapidity, the orbital and axial movements of the earth through these currents producing magnetic effects in a manner similar to the winding of an electromagnet through which a current passes.

In order that we may believe this to be the case, we must agree that the sun gives out electric waves continuously in every direction equal to the work of maintaining the earth as an electromagnet. For example, that during the forty-five years of the last century, when, according to computation from observed facts, the earth's magnetic moment hardly changed, these emanations were continuous. At present there does not appear to be any ground for such a belief.

In an endeavour to explain the hourly angular variations of the needle, it is submitted that the earth's magnetic poles probably occupy a considerable area round the centre of which certain centres of primary attraction in them make a daily circuit, due to the action of the sun as the earth rotates on its axis. In addition to the "primary" magnetic pole in North America, it is suggested that a "secondary" pole of a similar nature must exist in northern Siberia. The daily variations of the needle, both in declination and dip, in the northern hemisphere are then attributed to a battle for the mastery between the revolving centres of attraction in the two poles mentioned, modified as the magnetic equator is approached by the attraction of the south magnetic poles.

As one reads through several of the first chapters the fully expressed acceptance of the idea that the attraction of the needle by the magnetic poles is the immediate cause of its variations seems unaccountable, until a fundamental error is reached. This is when the author takes it as generally agreed that, in the same way as steel is attracted by the poles of an ordinary artificial magnet, the magnetic needle is attracted by the poles of that great natural magnet, the earth. Such a statement vitiates whole pages of the arguments adduced.

On the question of the position of the magnetic equator with regard to the terrestrial equator, the results of observation have also been too much ignored. There have not been four crossings of the two equators during the last sixty years, neither are the two known points of crossing regulated by the position of the magnetic poles as suggested. In the Atlantic region, the point of crossing seems to be chiefly regulated by local causes below the earth's surface.

It may be finally remarked that the chapter on magnetic storms is the most acceptable in the book.

OUR BOOK SHELF.

Mechanical Appliances, Mechanical Movements and Novelties of Construction. By Gardner D. Hiscox. Pp. 396. (London: Constable and Co., Ltd., 1905.) Price 12s. 6d. net.

THIS book is luxuriously printed, with clear figures, but it is difficult to say more in its praise. It consists of a series of short paragraphs, each with its illustration, describing some mechanical or constructional device. It is similar in plan to those "Centuries of Invention" of which the Marquis of Worcester's was the earliest (1746). The devices described are of the most heterogeneous character, old and new, important and unimportant, useful and useless. They are arranged in the roughest way in sections which have no relation to any natural order of classification. It is difficult to see to whom such a work appeals, but in fairness to the author it should be stated that a previous work

of which this is a continuation appears to have reached a tenth edition.

Section ii. is on the transmission of power. The first example is a screw-driver, and the second a sewer rod coupling. Another example is a cash conveyor, which, as money is power, is no doubt an example of transmission of power. On the next page is a viscosimeter, though what power is transmitted in this case is less obvious. Nor would one naturally expect four examples of acoustic telephones to be found under this heading.

Section vii., on hydraulic power and appliances, commences with some very sketchy ideas for wave motors, and then describes a fog-horn buoy. There is no reasonably good account of any one of the important class of water turbines, but there is a quite impossible design for a "multinozzle turbine," and next to this a duplex steam feed pump. There is a figure of a Venturi meter, but the description does not explain its action, and the curiously inaccurate statement is made that the differential velocity produces a differential pressure in two tubes with mouths turned in "opposite" directions, and ends with the very misleading statement that "the measurement is made by a meter." The reader would not realise that the Venturi tube is the meter, and that what the author probably mistakes for a meter is a recorder.

Section viii., on air power, motors and appliances, contains the "pneumatic ball puzzle," an "aërial top," "grain elevators," "a magic ball," a "megascope," a "sailing wagon," a "tail-less kite," and a "sail-rigged merry-go-round"; but nothing about the air-compressors, air-motors, and pneumatic tools which are now so important.

Enough has been said to indicate the general character of the work. Many useful and important devices are described amongst many others which are mere inventors' schemes. There may be readers who like an olla podrida of this kind.

Perhaps the most curious section, and we think the longest, is that on perpetual motions. About these the author does not seem to have quite made up his own mind. He does warn the reader in the preface that the problem is "unsolvable." But later, p. 363, he remarks that "attempts to solve this problem would seem, so far, only to have proved it to be thoroughly paradoxical," a statement which would hardly get many marks in a science examination. Further, we are told on the next page that, although admitting difficulties in the way of its discovery, "many eminent mathematicians have favoured the belief in the possibility of perpetual motion"; also that "it is evident, therefore, that even mathematicians are not agreed."

Modern Theory of Physical Phenomena, Radioactivity, Ions, Electrons. By Augusto Righi. Authorised translation by A. Trowbridge. Pp. xiii + 165. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd., 1904.) Price 5*s.* net.

IT is an interesting sign of the times that so many books have appeared during the last few months with the object of explaining in non-technical words the recent development of physical science. Part of the interest shown in these subjects by the general reading public is, no doubt, of the unintelligent and wonder-seeking order, which classes the more striking discoveries of natural science with the latest sensation of the law courts, or the cost of the flowers at a Transatlantic ball. But it is fair to hope that some, at all events, of those who read of the advance of knowledge do so with a desire to comprehend the method, as well as to admire the results, of scientific research. A more widely spread application of the open-minded and truth-seeking methods of science to the problems of individual and collective life is, for the sake of the community, greatly to be desired.

The little book before us deals in a light and interesting manner with the conceptions of the physical world which have been used of late in investigating the phenomena of light, electricity, and radio-activity. It states the results of recent inquiries in a clear and intelligible manner, and, if the account of the methods used in reaching the results sometimes seems inadequate, the difficulty of explaining those methods to non-scientific readers may be urged as an excuse.

After an introduction, the book contains chapters on electrolytic ions and electrons; electrons and the phenomena of light; the nature of the kathode rays; the ions in gases and solids; radio-activity; mass, velocity, and electric charge of the ions and of the electrons; and the electrons and the constitution of matter. The volume ends with a useful bibliography of the subjects considered.

The translation, on the whole, is well done, though a certain want of crispness in the literary style is felt in places.

In a future edition one or two corrections would be advisable. The period of vibration of light cannot be "expressed by a fraction whose numerator is unity and whose denominator is a number of fifteen places" unless it is understood that "a fraction" is a fraction of a second. The usual figure given to illustrate the opposite deflection by a magnetic field of the α and β rays from radium exaggerates greatly the deflection of the α rays compared with that of the β rays. This exaggeration is legitimate, in fact, necessary, in a diagrammatic representation; but it should be pointed out in the text, or misconception of the relative magnitudes of the two effects is sure to follow. In Thomson's method of determining the properties of the ions produced by the incidence of ultra-violet light on a metallic surface, the exactness is limited not only by the differing velocities of the ions, as stated in the book. Probably the ions are produced, not solely at the metallic surface, but also in a layer of the gas of finite thickness in its neighbourhood. Thus the distance from the surface reached against the influence of a magnetic field may be different for different ions even if their velocities be the same.

The Journal of the Royal Agricultural Society. Vol. lxv. Pp. clxvi + 392. (London: Murray, 1904.)

THE *Journal* of the Royal Agricultural Society makes its appearance this year in a rather slimmer form than usual, due, however, more to the use of a thinner paper than to a curtailment of the printed matter. The affairs of the society bulk largely as usual, taking up more than half the present volume, while the miscellaneous articles, to which the ordinary reader turns, only occupy about 150 pages. The volume is, in fact, burdened far too much with reports of council meetings and committees, which have lost all interest for the members by the time the annual volume reaches them, and which would be much more to the point if circulated as "proceedings" immediately after the meetings and not reprinted here.

The volume opens with a vivacious and readable account of Sir Humphry Davy by Mr. H. B. Wheatley, who well brings out the charm and fascination of Davy's personality. But we cannot help thinking Mr. Wheatley rates Davy's agricultural work altogether too highly; if any man is to be called "father of the science" it is De Saussure, and not Davy, who can be identified with no new discovery or novel point of view in agricultural science. In this respect Davy was somewhat like Liebig; both were great men who had the power of getting the world to listen to them, and when they turned their attention to agriculture the influence they wielded, each in their